2

IN THE SPECIFICATION

Please amend the paragraphs of the specification as follows:

Please replace the sub-heading before paragraph 1 on page 1 with the following amended sub-heading:

I.   Field ~~of the Invention~~

Please replace paragraph 1 on page 1 with the following amended paragraph:

The <u>disclosed embodiments</u> ~~present invention~~ pertain[[s]] generally to the field of wireless data communications, and more specifically to a method and apparatus for controlling vocoder frame generation in a discontinuous transmission communication system.

Please replace paragraph 3 on page 1 with the following amended paragraph:

In many wireless communication systems, human speech is converted into electronic signals and digitized. The digitized speech is often provided to a vocoder, which is a well known device in the art for compressing the digitized speech signal for efficient wireless transmission. The output of the vocoder comprises vocoder frames, which are <u>discrete</u> ~~discreet~~ "packages" of bits representing the compressed digitized speech. Vocoders may operate using either fixed or variable rate encoding techniques, both of which are well known in the art. In either case, vocoders operate to take advantage of natural pauses, or lapses, inherent in human speech to provide bandwidth compression. In some communication systems using fixed rate vocoders, vocoder frames are not transmitted during periods of speech inactivity, thereby reducing the bandwidth necessary for the communication.

3

Please replace paragraph 2 on page 2 with the following amended paragraph:

The disclosed embodiments are ~~present invention is~~ directed to a discontinuous transmission controller method and apparatus. In one embodiment, the disclosed embodiments are ~~present invention is~~ directed to an apparatus comprising a vocoder for generating vocoder frames from said digitized audio signal at a predetermined output rate if speech is present, for generating no vocoder frames during periods of speech inactivity, and for generating transition frames during transitions from speech activity to speech inactivity, the transition frames comprising background noise information.

Please replace paragraph 3 on page 2 with the following amended paragraph:

In another embodiment, the ~~present invention is directed to a~~ method ~~comprising~~ comprises ~~the steps of~~ determining a voice activity level in a digitized audio signal, and generating vocoder frames at a predetermined rate in a transmitter if speech activity is present. In no speech activity is detected, no vocoder frames are generated. During a transition period between speech activity and speech inactivity, transition frames are generated, the transition frames comprising background noise information.

Please replace paragraph 4 on page 2 with the following amended paragraph:

FIG. 1 illustrates a functional block diagram of a typical terrestrial wireless communication system employing the disclosed embodiments ~~of the present invention~~;

Please replace paragraph 3 on page 3 with the following amended paragraph:

FIGs. 8A, 8B, and 8C ~~8a, 8b, and 8c~~ illustrate the relationship between vocoder frames and a state vector as used in the transmitter of FIG. 7;

Attorney Docket No. 990502

4

Please replace paragraph 4 on page 3 with the following amended paragraph:

FIG. 8A 8a illustrates a sequential series of vocoder frames and a value of a state vector generated;

Please replace paragraph 2 on page 4 with the following amended paragraph:

Vocoder 204 is responsible for compressing the digitized audio information to minimize the bandwidth necessary for transmission. The output of vocoder 204 comprises vocoder frames, which are discrete discreet packages of information representing the compressed digitized speech. Vocoders may operate using either fixed or variable rate encoding techniques, both of which are well known in the art. In systems using variable-rate vocoders, bandwidth efficiency is achieved by encoding the digitized audio information in one of a number of different encoding rates, each encoding rate representative of the level of speech activity present in the audio information.

Please replace paragraph 3 on page 7 with the following amended paragraph:

One such rate decision algorithm is disclosed in U.S. Pat. No. 5,911,128, entitled "METHOD AND APPARATUS FOR PERFORMING REDUCED RATE VARIABLE RATE VOCODING," issued Jun. 8, 1999, assigned to the same assignee of the present invention and incorporated by reference herein. This technique provides a set of rate decision criteria referred to as mode measures. A first mode measure is the target matching signal to noise ratio (TMSNR) from the previous encoding frame, which provides information on how well the encoding model is performing by comparing a synthesized speech signal with the input speech signal. A second mode measure is the normalized autocorrelation function (NACF), which measures periodicity in the speech frame. A third mode measure is the zero crossings (ZC) parameter, which measures high frequency content in an input speech frame. A fourth measure, the prediction gain differential (PGD), determines if the encoder is maintaining its prediction efficiency. A fifth measure is the energy differential (ED), which compares the energy in the current frame to an average frame energy. Using these mode measures, a rate determination logic selects an encoding rate for a current vocoder frame. Voice activity detector 406 determines the level of voice activity from the rate determination. For example, voice activity detector 406 generates a control

5

signal indicative of high voice activity if the rate determination algorithm selects full rate encoding.

Please replace paragraph 1 on page 9 with the following amended paragraph:

FIG. 6 illustrates a second embodiment of controlling the discontinuous transmission process. In this embodiment, the voice activity detector 504 506 of FIG. 5 is replaced by a background noise suppression element 604 606 to determine voice activity instead of voice activity detector 504 506. All other functional blocks shown in FIG. 6 operate in a similar way to the functional blocks of FIG. 5.

Please replace paragraph 2 on page 9 with the following amended paragraph:

Background noise suppression element 606 provides a control signal based upon detection and suppression of background noise, such as undesired noise from automobile traffic, wind, crowds, and so on. One example of such a noise suppressor is found in U.S. patent number 6,122,384 (the '384 patent) entitled "NOISE SUPPRESSION SYSTEM AND METHOD", assigned to the same assignee of the present invention and incorporated by reference herein.

Please replace paragraph 3 on page 9 with the following amended paragraph:

Typically, noise suppression element 604 606 generates a control signal having two states: an encode state and a disable state. The control signal is provided to parameter modification unit 608 610 so that parameter modification during transition periods can take place. The noise suppression element described by the '384 patent comprises a rate decision element used to determine the level of voice activity. The rate decision element may be used by noise suppression element 606 to determine when to transition between states. In another embodiment, the rate decision element provides a control signal directly to parameter modification unit 608.

6

Please replace paragraph 4 on page 9 with the following amended paragraph:

The control signal from voice activity detector 504 <s>506</s> or noise suppression unit 604 can be used in elements other than vocoder 204 to further control the discontinuous transmission process. For example, FIG. 7 illustrates a transmitter 700 comprising encryption module 712 <s>710</s>. Such a transmitter is used to safeguard voice or data communications from unauthorized third parties using techniques such as public key encryption.

Please replace paragraph 1 on page 11 with the following amended paragraph:

FIG. 8A <s>8a</s> illustrates a sequential series of vocoder frames numbered one through six and the value of the state vector generated by state vector generator 710 corresponding to each vocoder frame. In one embodiment, vocoder frames are generated at a constant output rate of one frame every 20 milliseconds by vocoder 704. Each vocoder frame may be stored briefly in memory 706 prior to use by encryption module 712. In an alternative embodiment, vocoder frames are provided directly to encryption module 712. In either case, vocoder frames are provided to encryption module 712 via switch 708 at the same rate that vocoder 704 produces vocoder frames. State vector generator 710 is incremented at the predetermined rate, generally a multiple of the rate at which vocoder frames are generated by vocoder 704.

Please replace paragraph 2 on page 11 with the following amended paragraph:

In FIG. 8A <s>8a</s>, vocoder frame 1 is encoded by encryption module 712, using a codebook derived from state vector 1. Frame 2 is next encoded, using a codebook derived from state vector 2. Frame 3 is next encoded, using a codebook derived from state vector 3, and so on. In a receiver, the encrypted vocoder frames are decrypted using a state vector which is synchronized to frames being encrypted at transmitter 700. In other words, vocoder frame 1, which was encrypted using a codebook derived from state vector 1, is decrypted using a codebook derived from a state vector equal to 1. Vocoder frame 2 is decrypted using a codebook derived from a state vector equal to 2, and so on.

7

Please replace paragraph 3 on page 11 with the following amended paragraph:

FIG. 8B 8b illustrates a problem of the encryption process of FIG. 7a when an inactive vocoder frame is generated by vocoder 704. As before, vocoder frames 1 through 6 are shown in sequence as generated by vocoder 704. First, an active vocoder frame 1 is generated and encoded by encryption module 712 (with or without the use of memory 706) using a codebook derived from state vector 1. Next, an active vocoder frame 2 is generated by vocoder 204 and then encrypted using a codebook derived from state vector 2. Next, frame 3 is generated by vocoder 704, however, in this example, frame 3 is an inactive vocoder frame. The control signal from vocoder 704 opens switch 708 so that the inactive vocoder frame is not encrypted by encryption module 712. The inactive frame is generally over-written in memory 706 with frame 4 in the following 20 millisecond time interval. If state vector generator 710 is allowed to continue to increment, a codebook resulting from state vector 3 is generated, but because a vocoder frame has not been provided to encryption module 712, an encrypted frame is not generated. Next, vocoder frame 4 is generated and encrypted using a codebook derived from state vector 4.

Please replace paragraph 1 on page 12 with the following amended paragraph:

In this embodiment, when an inactive vocoder frame is generated by vocoder 704, state vector generator 710 is disabled by the control signal from vocoder 704 so that a state vector is not incremented during times when inactive frames are generated. This is illustrated in FIG. 8C 8c.

Please replace paragraph 2 on page 12 with the following amended paragraph:

As shown in FIG. 8C 8c, vocoder frames 1 through 6 are generated by vocoder 704. However, in this example, vocoder frames 3, 4, and 5 comprise inactive frames. Vocoder frame 1 is encoded using a codebook derived from state vector 1. Vocoder frame 2 is encoded using a codebook derived from state vector 2. When voice activity drops to a low threshold, inactive vocoder frames 3, 4, and 5 are generated by vocoder 704. Vocoder 704 sends a control signal to state vector generator 710, disabling the state vector generator from incrementing for the duration

8

of frames 3, 4, and 5. Switch **708** is also opened to prevent the inactive frames from being encrypted. When voice activity is detected once again, the control signal from vocoder **704** enables state vector generator to resume its count, in this example, to a value of 3. Therefore, vocoder frame 6 is encrypted using a codebook derived from state vector 3.

Please replace paragraph 2 on page 13 with the following amended paragraph:

Decryption module **908** is responsible for decrypting each vocoder frame stored in receive buffer **906** with a unique codebook, similar to the technique used to encrypt data frames as discussed above. Generally, one codebook is generated for each vocoder frame to be decrypted, generally at the same rate that frames are generated by vocoder **704** at transmitter **700**. Therefore, one codebook is generally available for each vocoder frame to be decrypted. Other techniques allow two vocoder frames to <u>be</u> decrypted with one codebook, the codebook having twice as many bits as one vocoder frame.

Please replace paragraph 6 on page 13 with the following amended paragraph:

The coordination of the above processes is generally handled by processor **914**. Processor **914** can be implemented in one of many ways which are well known in the art, including a <u>discrete</u> ~~diseret~~ processor or a processor integrated into a custom ASIC. Alternatively, each of the above block elements could have an individual processor to achieve the particular functions of each block, wherein processor **914** would be generally used to coordinate the activities between the blocks.